Test report no.: **131346/18-I**

Customer:
ALPHACAN S.p.A.
Via Santa Caterina, 60/C
38062 ARCO (TN)
ITALY

Production site:
38062 ARCO (TN)
ITALY

Order:
Testing of colour fastness, classification S, according to DIN EN 12608-1: 2016-08 "Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors - classification, requirements and test methods".

Artificial weathering according to DIN EN 513, procedure 2 (severe climate zone S) up to an raised total irradiation dose equivalent of altogether 24 GJ/m^2 in the wave length range of 300 nm to 800 nm.

E-Mail dated: 2018-07-02
2018-11-07

Reference: Ms. Clara Bortolameotti

Test samples received on: 2018-09-18

Test period: 2018-09-20 to 2020-03-10

This test report consists of 9 pages.

Würzburg, 23 March 2020
Fs/km

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1. Order

By its e-mails of 2 July 2018 and 7 November 2018, the company Alphacan S.P.A., Viale dell´ Industria 1, 38057 Pergine Valsugana (Trento), ITALY, instructed SKZ - Testing GmbH to test colour fastness, classification S, according to DIN EN 12608-1: 2016-08 "Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors - classification, requirements and test methods".

Artificial weathering was carried out according to DIN EN 513: 1999-10 and 2019-03, respectively, procedure 2 (severe climate zone S) up to an **raised** irradiation dose equivalent of altogether **24 GJ/m²** in the wave length range of 300 nm to 800 nm.

2. Test material

SKZ - Testing GmbH had the following test material at their disposal on 18 September 2018:

Each 2 x 1 m window profile sections, made of PVC-U

Sample 1: White - formulation PEN 716

Designation of profile:	---
Marking of profile:	(TR) CSTB 553 17/07/18 12:57 380
Manufacturer of profile:	Alphacan S.P.A., 38062 Arco, ITALY
Production site:	Alphacan S.P.A., 38062 Arco, ITALY
Manufacturer / place of mixture:	Alphacan S.P.A., 38062 Arco, ITALY

Sample 2: White - formulation PEN 776

Designation of profile:	---
Marking of profile:	(TR) CSTB 553 11/07/18 12:12 380
Manufacturer of profile:	Alphacan S.P.A., 38062 Arco, ITALY
Production site:	Alphacan S.P.A., 38062 Arco, ITALY
Manufacturer / place of mixture:	Alphacan S.P.A., 38062 Arco, ITALY

Sample 3: Sand - formulation PEN 716

Designation of profile:	---
Marking of profile:	(TR) CSTB 553 17/07/18 16:55 380
Manufacturer of profile:	Alphacan S.P.A., 38062 Arco, ITALY
Production site:	Alphacan S.P.A., 38062 Arco, ITALY
Manufacturer / place of mixture:	Alphacan S.P.A., 38062 Arco, ITALY

3. Execution of test

Following tests were performed according to DIN EN 12608-1: 2016-08, item 5.9 weathering resistance, climate zone S, artificial weathering was carried out according to DIN EN 513: 1999-10 and 2019-03, respectively, procedure 2 (severe climate zone S) up to an total irradiation dose equivalent of altogether 24 GJ/m^2 in the wave length range of 300 nm to 800 nm.

Unless otherwise noted all tests were carried out at standard atmosphere 23/50, class 1 according to DIN EN ISO 291: 2008-08.

Usually we carry out tests according to standards for which we have an accreditation. The list of all standards for which we are accredited is shown on the homepage at www.skz.de. In case of non-accredited procedures they are marked with *.

3.1 Colour fastness

Testing of colour fastness was performed according to DIN EN 513: 1999-10 and 2019-03, respectively, Procedure of artificial weathering is based on the requirements according to DIN EN 513, procedure 2, simulation of a severe climate zone (S). Surface outside was irradiated.

Parameters of weathering device

Type of weathering device:	XENOTEST® BETA
Light source:	Xenon-arc source
Filter:	Terrestrial daylight simulation
Black standard temperature:	65 ± 3 °C
White standard temperature:	45 - 50 °C
Relative humidity:	65 ± 5 %
Spray cycle:	6 min water spray, 114 min dry cycle
Irradiation energy E_{UV} (300 - 400) nm:	60 ± 2 W/m²
Total irradiation dose equivalent in the wavelength range (300 - 800) nm:	**24 GJ/m²**
Exposure period:	12222 h
Start:	2018-09-21
End:	2020-03-10

3.1.1 Visual assessment

Visual assessment was carried out according to ISO 4582: 2007-08 by using grey scale according to DIN EN 20105-A03: 1994-10 and grey scale according to DIN EN 20105-A02: 1994-10.

3.1.2. Colorimetric assessment

The colorimetric assessment was carried out by a spectrophotometer in wavelength range from 360 to 750 nm, standard light type D65, gloss inclusion, 10° standard observation. The colour distance ΔE^*_{ab} was determined according to ISO 7724-3: 1984-10.

Requirement (after a irradiation dose equivalent of 12 GJ/m²):

After artificial weathering colour distance ΔE^*_{ab} between unweathered and weathered samples shall not be larger than 5 and colour distance Δb^* shall not be larger than 3.

4. Test results

4.1 Colour fastness

4.1.1 Visual assessment

Sample 1: White - formulation PEN 716

Time of exposure	Total irradiation dose equivalent	Fastness grade according to DIN EN 20105		Remark
		A02	A03	
1000 h	2 GJ/m²	4 - 5	4 - 5	lighter
2000 h	4 GJ/m²	4 - 5	4 - 5	lighter
3000 h	6 GJ/m²	4 - 5	4 - 5	lighter, duller
4000 h	8 GJ/m²	4 - 5	4 - 5	lighter, duller
5000 h	10 GJ/m²	4 - 5	4 - 5	lighter, duller
6111 h	12 GJ/m²	4	4 - 5	lighter, duller
7000 h	14 GJ/m²	4	4 - 5	lighter, duller
8000 h	16 GJ/m²	4	4 - 5	lighter, duller
9000 h	18 GJ/m²	4	4 - 5	lighter, duller
10000 h	20 GJ/m²	4	4 - 5	lighter, duller
11000 h	22 GJ/m²	4	4 - 5	lighter, duller
12222 h	24 GJ/m²	4	4 - 5	lighter, duller

Sample 2: White - formulation PEN 776

Time of exposure	Total irradiation dose equivalent	Fastness grade according to DIN EN 20105		Remark
		A02	A03	
1000 h	2 GJ/m²	4 - 5	4 - 5	lighter
2000 h	4 GJ/m²	4 - 5	4 - 5	lighter
3000 h	6 GJ/m²	4 - 5	4 - 5	lighter, duller
4000 h	8 GJ/m²	4 - 5	4 - 5	lighter, duller
5000 h	10 GJ/m²	4 - 5	4 - 5	lighter, duller
6111 h	12 GJ/m²	4	4 - 5	lighter, duller
7000 h	14 GJ/m²	4	4 - 5	lighter, duller
8000 h	16 GJ/m²	4	4 - 5	lighter, duller
9000 h	18 GJ/m²	4	4 - 5	lighter, duller
10000 h	20 GJ/m²	4	4 - 5	lighter, duller
11000 h	22 GJ/m²	4	4 - 5	lighter, duller
12222 h	24 GJ/m²	4	4 - 5	lighter, duller

Sample 3: Sand - formulation PEN 716

Time of exposure	Total irradiation dose equivalent	Fastness grade according to DIN EN 20105		Remark
		A02	A03	
1000 h	2 GJ/m²	4 - 5	4 - 5	lighter
2000 h	4 GJ/m²	4 - 5	4 - 5	lighter
3000 h	6 GJ/m²	4	4 - 5	lighter, duller
4000 h	8 GJ/m²	4	4 - 5	lighter, duller
5000 h	10 GJ/m²	4	4 - 5	lighter, duller
6111 h	12 GJ/m²	4	4 - 5	lighter, duller
7000 h	14 GJ/m²	4	4 - 5	lighter, duller
8000 h	16 GJ/m²	4	4 - 5	lighter, duller
9000 h	18 GJ/m²	3 - 4	4	lighter, duller
10000 h	20 GJ/m²	3 - 4	4	lighter, duller
11000 h	22 GJ/m²	3 - 4	4	lighter, duller
12222 h	24 GJ/m²	3 - 4	4	lighter, duller

There were no visible spots, bubbles, stripes or cracks or other considerable damages on surface.

4.1.2 Colorimetric assessment

Sample 1: White - formulation PEN 716

Time of exposure	Total irradiation dose equivalent	Colour coordinates			Colour distance ΔE^*_{ab}
		ΔL^*	Δa^*	Δb^*	
1000 h	2 GJ/m²	1.0	0.1	-1.4	1.7
2000 h	4 GJ/m²	1.2	0.0	-0.9	1.5
3000 h	6 GJ/m²	1.4	0.1	-1.6	2.1
4000 h	8 GJ/m²	1.3	0.1	-1.7	2.1
5000 h	10 GJ/m²	1.4	0.0	-1.7	2.2
6111 h	12 GJ/m²	1.4	0.0	-1.6	2.1
7000 h	14 GJ/m²	1.4	0.0	-1.6	2.1
8000 h	16 GJ/m²	1.4	0.0	-1.6	2.1
9000 h	18 GJ/m²	1.3	0.0	-1.6	2.1
10000 h	20 GJ/m²	1.3	0.0	-1.6	2.1
11000 h	22 GJ/m²	1.4	0.0	-1.7	2.2
12222 h	24 GJ/m²	1.4	0.0	-1.7	2.2

Sample 2: White - formulation PEN 776

Time of exposure	Total irradiation dose equivalent	Colour coordinates			Colour distance ΔE^*_{ab}
		ΔL^*	Δa^*	Δb^*	
1000 h	2 GJ/m²	0.7	0.2	-0.9	1.2
2000 h	4 GJ/m²	0.7	0.1	-0.5	0.9
3000 h	6 GJ/m²	1.0	0.1	-0.6	1.2
4000 h	8 GJ/m²	1.1	0.2	-0.9	1.4
5000 h	10 GJ/m²	1.1	0.2	-0.8	1.4
6111 h	12 GJ/m²	1.0	0.1	-0.8	1.3
7000 h	14 GJ/m²	1.0	0.2	-0.8	1.3
8000 h	16 GJ/m²	1.1	0.1	-0.6	1.3
9000 h	18 GJ/m²	1.2	0.2	-0.7	1.4
10000 h	20 GJ/m²	1.0	0.2	-0.8	1.3
11000 h	22 GJ/m²	1.0	0.2	-0.8	1.3
12222 h	24 GJ/m²	1.1	0.1	-0.9	1.4

Sample 3: Sand - formulation PEN 716

Time of exposure	Total irradiation dose equivalent	Colour coordinates			Colour distance
		Δ L*	Δ a*	Δ b*	Δ E^*_{ab}
1000 h	2 GJ/m²	0.7	0.0	-0.7	1.0
2000 h	4 GJ/m²	1.4	0.1	-1.7	2.2
3000 h	6 GJ/m²	2.2	0.2	-3.9	4.5
4000 h	8 GJ/m²	1.9	0.2	-3.2	3.7
5000 h	10 GJ/m²	1.7	0.2	-3.0	3.5
6111 h	12 GJ/m²	1.2	0.1	-1.5	1.9
7000 h	14 GJ/m²	1.5	0.1	-2.6	3.0
8000 h	16 GJ/m²	1.7	0.1	-2.5	3.0
9000 h	18 GJ/m²	1.7	0.1	-2.6	3.1
10000 h	20 GJ/m²	1.6	0.1	-2.5	3.0
11000 h	22 GJ/m²	1.6	0.1	-2.4	2.9
12222 h	24 GJ/m²	1.5	0.1	-2.4	2.8

5. Assessment of test results

The requirements according to DIN EN 12608-1: 2016-08, related to an irradiation dose equivalent of 12 GJ/m², regarding fastness to weathering and classification to climate zone S (severe climate) with a raised total irradiation dose equivalent of 24 GJ/m^2 were met.